WORK PLAN

for

AERIAL PILOT CONTROL PROJECT

COMPARISON OF ORTHENE FOREST SPRAY AT 0.5 LB AND 0.67 LB IN 1 QT and 2 QT APPLICATION RATES PER ACRE AGAINST THE EASTERN SPRUCE BUDWORM

Prepared by

Dr. Imants Millers, Entomologist

Portsmouth F.O., NA, S&PF, Forest Service USDA

INTRODUCTION

Outbreaks of the Spruce Budworm, Choristoneura fumiferana (Clem.), have persisted in the northeastern U.S. for more than a decade. Recently the outbreak has expanded from Maine into New Hampshire, New York and Vermont. Large acreages have been treated with insecticides in the last few years. A variety of insecticides are registered for use with the Environmental Protection Agency (EPA), though not all are being used (USFS 1978).

Cythion™, Dipel™, Malathion™ LV, Sumithion™ and Thuricide™ B have EPA registrations for spruce budworm control, but field tests and pilot control projects in Maine have shown these chemicals do not provide adequate control (USFS 1978). Sevin™ 4 Oil at 3/4 lb a.i. is the most frequently used material. Dylox™ 4 and Orthene™ Forest Spray are used for special areas. The latter 2 materials are more expensive at present application of 3/4 lb and 2/3 lb rates per acre, respectively. Maine Bureau of Forestry has requested that the USFS test reduced dosages and volumes of application of Orthene™ Forest Spray.

Water Soluble Orthene™ Forest Spray was tested by the U.S. Forest Service in 1976 and found effective at the 2/3 lb rate per acre (8 oz acephate, the active ingredient), applied in water at 2 quarts per acre (Ford, in press). As a result, about 40,000 acres in Maine were sprayed in 1977 to control eastern spruce budworm.

Acephate, the active insecticide in Orthene Forest Spray, appears to be of low toxicity to aquatic and warm-blooded animals at the registered application rate. However, toxicity hazards and the cost of application may be reduced through reduction in dosage and volume of application.

The efficacy of Orthene Forest Spray at the 2/3 lb rate in 2 qts per acre was demonstrated by Dimond, 1975, and Ford (in press, tests in 1976). Possible success with reduced dosages and application volumes are suggested by results in the field tests by Armstrong and Nigam (1975).

The following table estimates potential savings for an assumed project of 60,000 acres. Costs are based on market conditions in Maine.

COST COMPARISON OF REDUCED DOSAGES AND VOLUMES OF ORTHENE FOREST SPRAY

Active Ingredient Acephate

		8 oz/2 qts	8 oz/1 qt	6 oz/2 qts	6 oz/1 qt
A.	Insecticide	210,000	210,000	157,500	157,500
B.	Aircraft	150,000	75,000	150,000	75,000
C.	Personnel	60,000	30,000	60,000	30,000
	TOTAL	420,000	315,000	367,500	262,500
	Cost/A	$7.00	$5.25	$6.125	$4.375
	% Savings	---	25%	12.5%	37.5%

OBJECTIVES

The main purpose of the pilot project is to reduce application costs and environmental contamination resulting from use of the presently registered rate of 2/3 lb Orthene Forest Spray (8 oz active ingredient - acephate) in 1/2 gallon of water per acre. Reduced dosage of insecticides and reduced volume of final mix will be compared to the registered rate to determine if 90 percent budworm mortality, survival of less than 1 budworm per sample twig, and 35 percent foliage protection, can be achieved with the reduced rates as suggested by previous research studies. The specific rates tested will be:

2/3 lb Orthene Forest Spray (8 oz active ingredient - acephate) in 1/2 gallon of water per acre.

2/3 lb Orthene Forest Spray (8 oz acephate) in 1/4 gallon water per acre.

1/2 lb Orthene Forest Spray (6 oz acephate) in 1/2 gallon water per acre.

1/2 lb Orthene Forest Spray (6 oz acephate) in 1/4 gallon water per acre.

The Chevron Chemical Company will be encouraged to register the reduced rates with the Environmental Protection Agency.

EXPERIMENTAL DESIGN

1. Assumptions

The major assumption will be that the test population, the spruce budworm and the balsam fir, is uniform and any differences in the effects of the treatment are the result of the treatment alone. Stand condition, previous defoliation levels, budworm population density and quality, weather and aircraft (pilots) contribute greatly toward the efficacy of a treatment. Ideally, each one of these variables should be replicated as part of the treatment. However, because of limited man-power and funding, our tests will strive toward uniformity in test populations and the conditions at the time of the tests.

2. Overview

TREATMENTS	BLOCKS (1)	CLUSTERS (10)	TREES (3)
8 oz 1/2 gallon	3	~~15~~ 30	~~135~~ 90
8 oz 1/4 gallon	3	~~15~~ 30	~~135~~ 90
6 oz 1/2 gallon	3	~~15~~ 30	~~135~~ 90
6 oz 1/4 gallon	3	~~15~~ 30	~~135~~ 90

360 pre samples
720 post spray samples

Prespray collections will be 1 branch per tree; postspray - 2 branches per tree. Orthogonal contrast analysis will be used to compare the treatments (Snedecor 1965 pg. 255).

3. Treatments and Location

The four treatments are identified in the objectives:

1. Standard or check - registered dosage of 2/3 lb Orthene Forest Spray in 2 qts water per acre.

2. 2/3 lb Orthene Forest Spray in 1 qt water per acre.

3. 1/2 lb Orthene Forest Spray in 2 qts water per acre.

4. 1/2 lb Orthene Forest Spray in 1 qt water per acre.

The treatment areas will be located in the general area of Greenville, Maine for protection from eastern spruce budworm.

4. Spray Blocks

Each spray block will be about 1 sq. mile (640 acres). About 1/2 mile buffers will be allowed between adjoining spray blocks. The boundaries of the spray blocks will be properly marked for pilots and aerial observers. Reconnaissance flights will be required to familiarize aerial crews.

Similar stand conditions and budworm population densities will be selected for each treatment. The specific treatment of a spray block will be selected at random.

5. Sample Clusters and Trees

Each sample cluster will consist of 3 dominant/codominant balsam fir trees located as closely together as possible. Ten clusters per spray block will be located in the central portion of the block. The clusters will be spaced to reduced chances of our spray swath covering more than 1 cluster.

Each tree will be identified and marked for resampling. The following codes will be used:

Volume	Dosage	Replicate	Cluster	Tree
2	8	1-3	0-9	1-3
2	6	1-3	0-9	1-3
1	8	1-3	0-9	1-3
1	6	1-3	0-9	1-3

6. Sample Branches

Each sample branch will be cut with a pole pruner from the mid-crown of the tree. It should be a terminal from a dominant branch, at least 5 ft. above the lowest foliated branch. The acceptable length of the branch will be from 15 in to 24 in. The sampling crews will be trained to cut branches at mean length of 18 in.

The sample branch must be cut without disturbing neighboring branches. The cut branch will be collected in a cloth bag attached to the cutting head of the pole pruner. The samples will be transferred to a paper bag, sealed, labelled and delivered to the laboratory. The paper bags will be stored in large plastic bags to reduce moisture loss. All sample material will be protected from direct sunlight.

7. Collections

Spruce budworm collections will be made about once a week after the budworms have emerged from hibernation. These are the development surveys. About 100 larvae will be collected from the spray area to determine average development. After majority of larvae are in the 3rd instar, collections will be increased to twice a week until spraying.

Control efficacy will be based on comparisons between conditions before and after spraying. Prespray collection of samples, 1 branch per tree, will be taken 1-3 days before spraying. Post-spray collections will be made 1 week after spraying and at peak pupation. These latter 2 surveys will have 2 branches collected per tree.

APPLICATION

1. Insecticide

Commercial grade Orthene Forest Spray (Trademark of Chevron Chemical Company) containing 75 percent water soluble acephate will be mixed in water to give the following final insecticide mixes:

6 oz acephate in 64 fl oz
8 oz acephate in 64 fl oz
6 oz acephate in 32 fl oz
8 oz acephate in 32 fl oz

Rhodamine B Extra S water soluble fluorescent red dye will be added to improve the spray deposit evaluation (1 lb dye per 100 gallons of final mix).

The aircraft spray sy stems will be washed out daily to prevent buildup of Hy-Sil (inert silicone non-soluble material in the insecticide), settling and degradation. Whenever possible, the insecticide will be mixed on the day of scheduled spraying. Water pH will be maintained near neutral.

2. Delivery

The insecticide will be applied from small fixed wing aircraft or helicopters equipped with Beecomist Rotary nozzles. The spraying system will be calibrated to deliver the 32 fl oz, or 64 fl oz, per acre as needed. The expected droplet size is between 80-100 microns mmd. A 50 mesh in line screen will be used to filter out large contaminant particles.

The insecticide will be applied under reasonably stable weather conditions - wind less than 6 mph; temperature 40°-70°F; relative humidity above 50 percent, but no dripping moisture on foliage. The aircraft will be flown at 50-100 ft above tree tops.

Pilots will be orientated to their spray blocks. Spray boundaries will be marked to assist pilots in navigation. Radio communications will be available for ground and air crews.

3. Timing

The insecticide will be applied after the balsam tree shoots have adequately flared to receive toxic dose of insecticide. Usually, this will be about June 10th, and larvae should be in the 4th instar.

4. Laboratory Examination

Experienced laboratory examination will be contracted with Maine Bureau of Forestry. The following data will be obtained:

Defoliation. Defoliation estimates used by Maine Bureau of Forestry will be made for each branch. In addition, a count of the number of new needles per 10 terminal shoots per branch will be made. A shoot is a growth that developed from the terminal bud of last years shoot. A missing shoot will have a value of 0 needles.

Budworms. The number of budworms for each branch will be counted and classed as follows:

a. small - 2nd and 3rd instar; yellowish-green bodies

b. medium - 4th and 5th instar, and parasitized older larvae

c. large - primarily 6th instar larvae

d. pupa - fully formed

e. adult - either adult moth from rearing, or pupal skin from emerged adult

Large larvae and pupae will be reared to determine adult emergence success.

PERFORMANCE MONITORING

The major emphasis will be to ensure proper application and to determine what was applied. The aircraft will be calibrated before contract acceptance. A crew will be assigned to the airport to ensure proper mixing and loading.

In the field, a "bird plane" will monitor the application. A special emphasis will be made to lay out the blocks so that boundary marking and recognition is adequate for successful operation.

Spray deposit cards will be set out in the open across the expected spray swaths near the sample blocks. The major purpose of the cards, will be to establish whether the sample block was sprayed. In addition, spray cards will be set out under sample trees, 4 cards per tree, 1 in each cardinal direction on the dripline of the crown. Spray deposit drop size, mass and drop frequency will be determined with the aid of the electronic spot counter (Quantimet), and the ASCAS program (MAG ASCAS Rpt.).

ORGANIZATION AND ADMINISTRATION

1. Organization Plan

The attached organization chart shows the basic lines of responsibility. The specific jobs will be described in an appendix to be prepared at a later date.

2. Cooperation

The proposed pilot control project will be carried out by USDA Forest Service personnel from the Portsmouth Field Office, State and Private Forestry, in cooperation with the State of Maine. The Forest Service will be responsible for technical planning, supervision and aerial application. The State of Maine will assist with landowner contacts

to acquire spray areas and provide man-power to be mutually agreed upon. The Forest Service will cover the expenses of the project (Appendix). State of Maine will be contracted for laboratory facilities and a crew for branch examination.

3. Safety Plan

To be prepared by the Safety Officer.

4. Support Services

All the major purchases and contracts will be arranged by the Broomall Support Services staff. The Project Leader will be designated as the Contracting Officer's Representative. All the necessary contract information will be provided by the Project Leader.

5. Reports

The primary responsibility for preparation of reports will be assigned to the Project Leader, Dr. I. Millers. A preliminary report and critique will be submitted to Maine Bureau of Forestry, and the Area Office by October 1, 1978. Final Report will be completed for publication by March 1, 1979. It will be prepared as an Area Report. Technical reviews will be solicited from the following:

Dr. John Dimond, University of Maine
Henry Trial, Maine Bureau of Forestry
R. Young, MAG, USFS
J. Barry, MAG, USFS
Dr. D. Grimble, SBW CANUSA

PROJECT ACTIVITIES

1. Establishment of blocks, clusters and trees

Field instructions are to be written.

2. Airport Facilities

Instructions will be written when the location is determined.

3. Insect Development Surveys

Weekly collections of larvae from the general area of the pilot control project will be made to determine emergence and development. A day-degree graph will be maintained to predict budworm development.

4. Larval Sampling

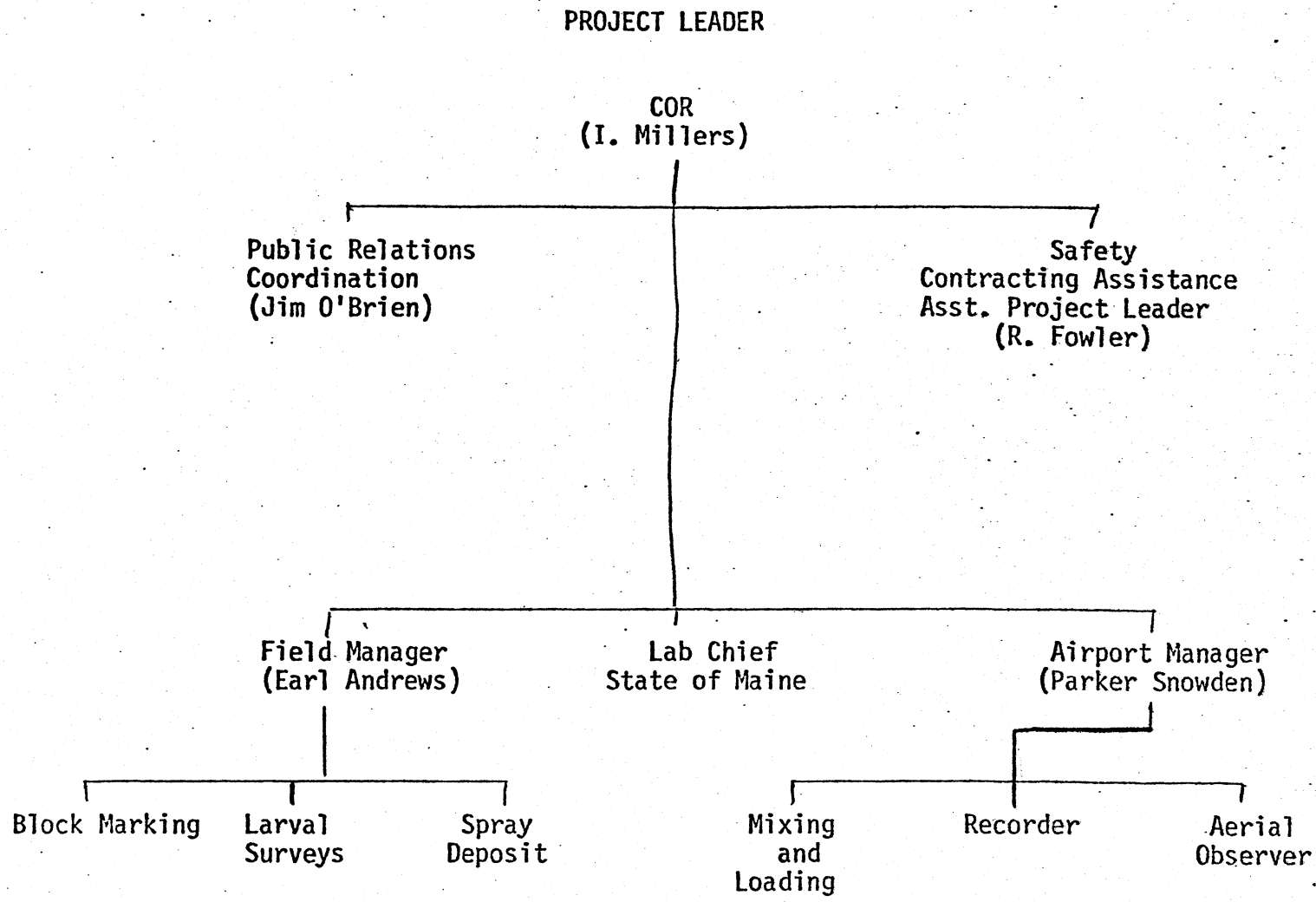
Larval samples will be collected one to two days before spraying. Foliage retention samples will be collected after pupation, or about four weeks after spraying. Each twig sample will be placed in a paper bag. The bags will be sealed, labelled and delivered to the field laboratory for examination. Sample twigs will be taken at random from the midcrown area. Preferably, each twig will be cut from a different cardinal direction.

5. Laboratory Examination

A crew of examiners will be trained to dissect field samples and to determine the number of spruce budworm larvae per twig, to determine the larval instars, and to estimate the degree of foliage retention.

6. Spray Deposit

Spray deposit cards will be sent to Kaye Johnson, CMB, Los Alamos Scientific Laboratory, New Mexico.



Organization Chart for the Maine Pilot Control Project - 1978

BUDGET REQUEST

WORK-FORCE		
Salaries		
Temporaries	$ 23,000	
Full Time (contributed)	-	
Overtime	5,000	
Per Diem		
Temporaries	10,000	
Full Time	6,000	
Sub Total	$ 44,000	$ 44,000
TRANSPORTATION AND VEHICLE RENTAL	5,000	5,000
AIRCRAFT		
Spray Planes	24,000	
Observation Plane	1,000	25,000
CHEMICALS		
Orthene	38,500	
Loading and Mixing	1,000	39,500
MISCELLANEOUS		
Spray Deposit Evaluation	3,500	
Report Preparation & Publication	1,000	
Supplies	2,000	6,500
TOTAL		$120,000

FLOW CHART

March	April	May		June	Begin Spraying June 7		
	Insecticide Ordered 4-3-78		Insecticide Delivery 5-22-78	Mixing Loading 6-5-78			
	Invitation To Bid 4-3-78	Aircraft Contract 5-8-78		Aircraft Calibration 6-6-78			
ork Plans Proposed 3-20-78	Approved 4-3-78	Development Surveys 5-8-78	Continue →	Prespray Surveys 6-6-78		First Postspray 6-13-78	Second Postspray 6-30-78
				Spray Cards Set 6-6-78		Laboratory 6-7-78	Continue →
	General Location 4-3-78	Area Selection 5-8-78	Spray Blocks Selected 5-22-78	Marked 6-6-78		Boundary Clean-up 6-8-78	Plot Clean-up 6-30-78
		Field Crew Selection 5-8-78	Field Crews On Site 5-22-78				

ADDENDUM II

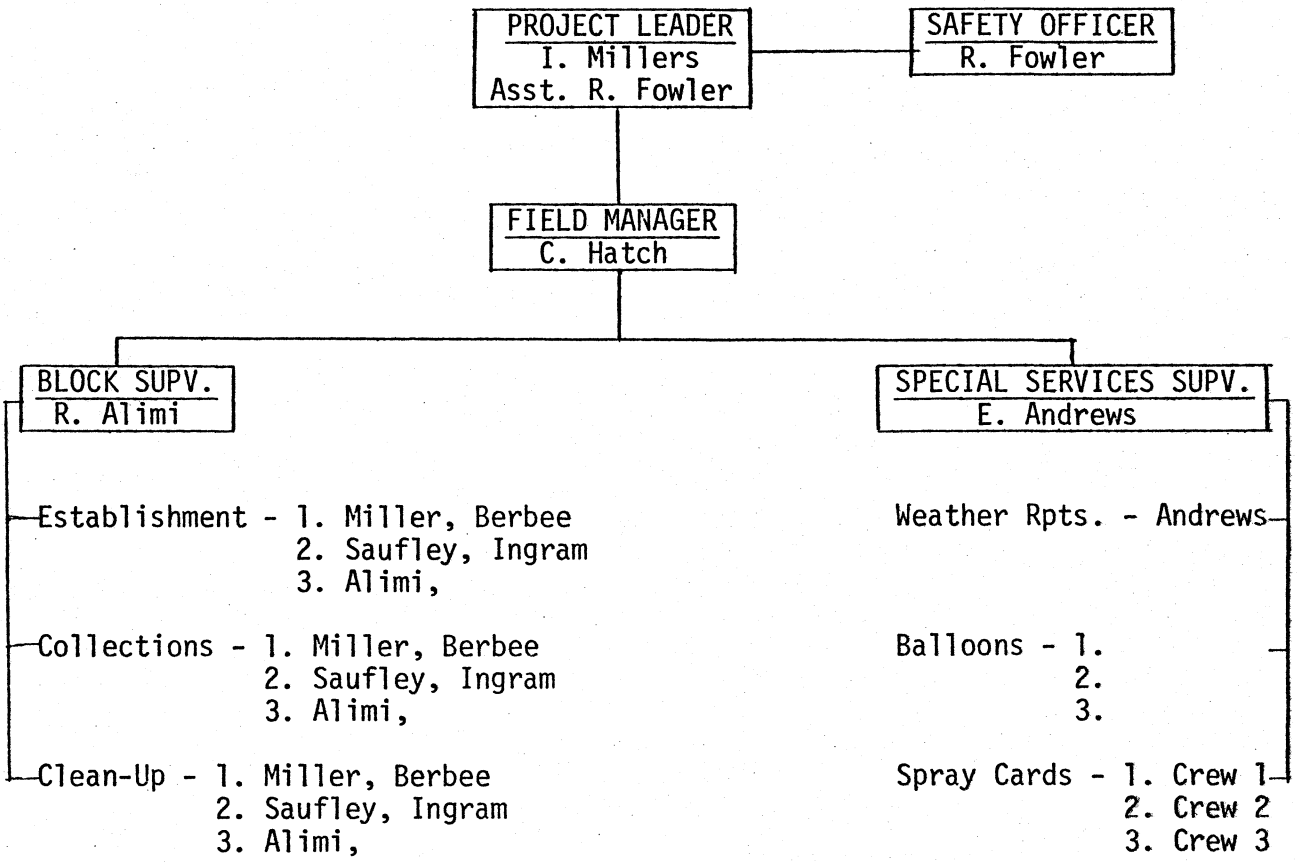
WORK PLAN FOR AERIAL OPERATIONAL TEST

"Comparison of Orthene Forest Spray at 0.5 lb and 0.67 lb in 1 qt and 2 qts Application Rates Per Acre Against the Eastern Spruce Budworm"

FIELD OPERATIONS

May 8, 1978

FIELD ORGANIZATION AND RESPONSIBILITIES



FIELD MANAGER (FM) - C. Hatch

The FM is directly responsible to the Project Leader for overseeing field operations to ensure proper and timely completion of field activities. He will directly supervise the Block Supv. and Special Services Supv. The FM will notify Project Leader of any difficulties encountered that might effect success of the project.

BLOCK SUPV -

He is directly responsible to the Field Manager for proper establishment of spray blocks, collection of larval samples and clean-up after completion of the project. He will supervise 3 crews of 2 persons each. Each crew will be assigned to 4 blocks for a primary responsibility of establishment and collecting.

SPECIAL SERVICES SUPV. -

He is directly responsible to the Field Manager for spray deposit assessment, boundary marking for aircraft and weather reporting during operation. He will supervise 3 crews during aerial operations, assigned to him from the Field Head.

ESTABLISHMENT OF TREATMENT BLOCKS AND SAMPLE CLUSTERS

A. RECONNAISSANCE

1. Aerial flight of potential work area - tentative sketch mapping of all potential spray blocks.

2. Examination of type maps and aerial photographs to confirm or adjust sketch maps.

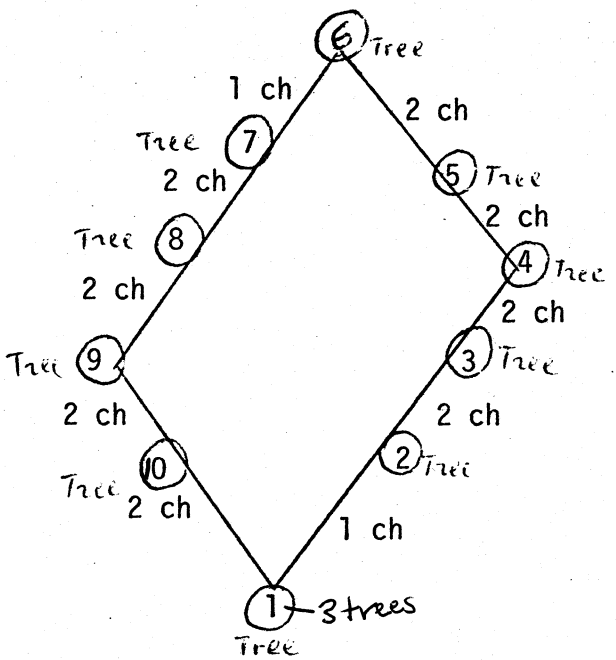
3. Select best 12 treatment blocks.

B. ESTABLISHMENT OF BLOCKS

1. In the middle of each block, confirm satisfactory budworm population of 5 larvae/18-inch branch.

2. Determine spray boundaries from the map and mark corners, boundary lines or both. DO NOT PLACE BLOCK CODES ON TAGS - USE ALPHABETICAL CODE AS SHOWN ON MAP. That will be done after treatment assignments

3. In the middle portion of the block select 10 clusters of 3 trees - dominant, open grown fir. Follow the attached schematic for cluster location. It is designed this way to decrease possibility of one swath spraying more than one cluster.



1 crew / 4 spray blocks

COLLECTIONS

A. DEVELOPMENT SAMPLING

The primary purpose is to predict when larval population development and bud growth of balsam fir is ready for spraying. The target date for spraying will be when majority of larvae are with 4th instar and older and the balsam fir buds have flared to where each needle can be sprayed.

Much of the early development survey will be coordinated with similar surveys made by Maine Bureau of Forestry and by Stauffer Chem. Co. After most larvae have reached the 3rd instar, bi-weekly samples will be collected from the test area. Each sample will consist of 100 larvae. The percentages of instars will be calculated and reported to project leader.

B. PRESPRAY COLLECTION

1. Prespray samples will be collected 1 day before targeted spray day.

2. First collections will include 6 blocks selected for spraying on the 1st day. Next day, the last 6 blocks will be sampled.

3. If spraying is delayed more than 2 days, each tree will be resampled in the same order.

4. One 18-inch branch will be cut from each sample tree and delivered to the laboratory for examination. Branches will be cut at approximately mid-third of the crown.

C. POSTSPRAY LARVAL COLLECTION

1. Preferably, crews will return to their blocks to make postspray collections.

2. Collections will begin 7 days after spraying, except for adjustments to avoid overtime work.

3. Postspray samples will be taken in the same manner, except that TWO BRANCHES, 18 inches long, will be cut from each tree.

4. More care should be exercised at this time to avoid loss or addition of larvae from neighboring branches.

D. POSTSPRAY PUPAL SURVEY

1. Again, the crews will return to their blocks.

2. Pupal postspray survey will begin when about 90 percent of budworms have pupated, but before more than 10 percent have emerged into adults.

3. Collections will be made in the same manner as before.

4. When collection is completed, remove tags and markers.

E. CREW TRAINING AND SELECTION

1. At least 1 day will be set aside for training on branch sampling.

2. Each crew member certified to operate pole pruners will be required to demonstrate the following:

a. strength to handle the poles

b. agility and temperament to cut branches

c. vision and judgement to select proper length

d. average branch length for 10 whould be within 17 in. to 19 in., with none exceeding 4 inches above or below 18 inches.

3. Each crew will have at least 1 certified sampler and 1 assistant.

4. Hard hats will be worn by all crews in pole pruning type of work or in the vicinity of sampling.

5. Minimum of 3 crews are required.

6. Storage of samples and coding will be as follows:

a. Samples and all larvae in the pruner bag will be transferred to a paper bag. The top of bag will be folded 2-3 times and stapled closed at 3 points.

b. The bag will show tree ID number (block, cluster, tree), date of collection, and crew.

c. All (10) the paper bags from a block will be placed in a garbage bag (plastic) and delivered to the lab within a day.

d. Do not expose samples to direct sunlight.

EVALUATION OF SPRAY COVERAGE

The primary purpose for the evaluation is to determine if adequate coverage was achieved for each cluster of trees. No attempt will be made to correlate volume or mass of insecticide deposited on spray cards and budworm control achieved in the trees.

A. PREPATORY WORK

One of the major problems in Maine has been the condensation found on the spray cards. It is believed that the plastic card holders increase condensation. This should be evaluated in the laboratory and proper replacement found.

1. Cool off card holders down to freezing. Then expose them to high humidity.

2. Do the same (No. 1) to spray-cards.

3. Do the same with corrugated cardboard.

4. Do the same with other materials if needed to find one that creates the least condensation.

5. Field test the final product outdoors; particularly to determine moisture levels on cards left out overnight.

6. Organize and mark cards for field work.

B. This assumes that the tests in section A will give positive results.

1. Cards will be set out at the rate of 4 cards per sample tree. Label cards at the bottom by tree number.

2. Instead of placing cards at the dripline, a nearby opening will be used. An opening is defined as a spot, about 10 ft. diameter, that has open sky abovt it.

3. Set out cards in the middle of the opening.

4. Use wire holders, when needed to get the cards above surrounding lower vegetation to avoid screening.

5. Collect cards about 1 hour or more after spraying.

6. In the laboratory determine the number of drops per cm^2.

C. LABORATORY EVALUATION

1. Establish a 2 cm^2 optical field using 60 magnifications on a dissecting microscope.

2. At random examine 5 spots on the spray card and count all the red spray drops (ignore size).

3. Record the count by tree card number. If the count is 0, check the card more thoroughly to find presence of any red stains. If at least 1 is present, record it with a (✓) check mark.

D. RESERVE PLAN

If the laboratory tests show that heavy condensation on spray cards can not be prevented, the cards will have to be placed in the field on the morning of spraying. Card location will be marked before in the same positions as described earlier (B.). Card evaluation will be done in the same manner as outlined in C.

WEATHERMAN

He is directly responsible to the Field Manager during aerial application of insecticide. About 1/2 hour before spraying he records the following data and reports them to the Airport Manager:

1. temperature
2. dry and wet bulb readings
3. wind conditions on ground
4. wind conditions at tree top level
5. moisture on foliage

Similar reports are required every 15 minutes during the operation, unless requested more frequently.

Smoke pots may be used to determine height and intensity of inversion layers.

BOUNDARY MARKING

The primary purpose of boundary marking is to guide spray craft to the spray block and to show him the area that needs the treatment.

Boundary marking supervisor, in cooperation with the pilots and Project Leader will determine the intensity of marking needed. Balloons will be used for marking purposes.

ADDENDUM III

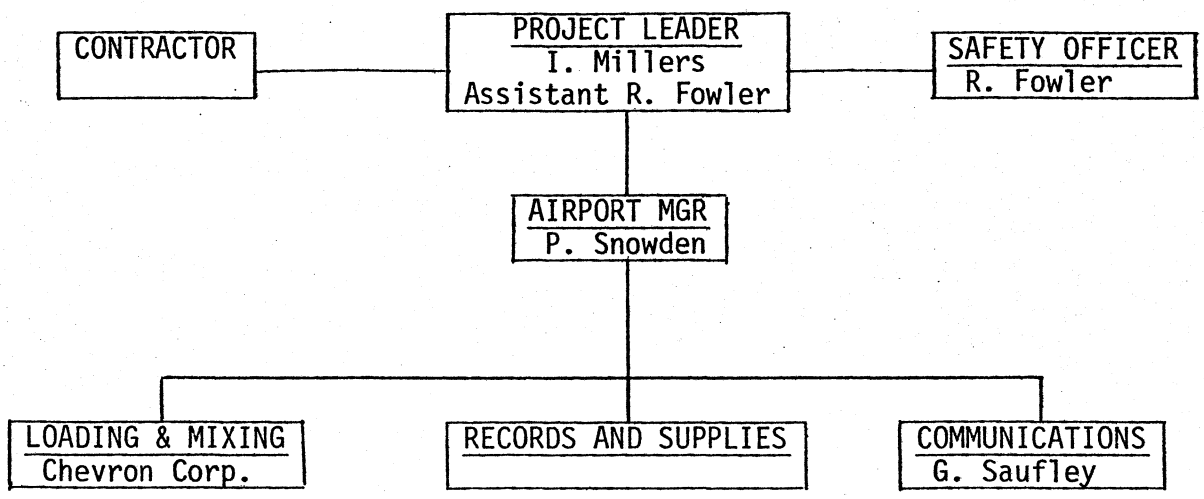
WORK PLAN FOR AERIAL OPERATIONAL TEST

"Comparison of Orthene Forest Spray at 0.5 lb and 0.67 lb in 1 qt and 2 qts Application Rates Per Acre Against the Eastern Spruce Budworm"

AIRPORT OPERATIONS

May 9, 1978

AIRPORT ORGANIZATION AND RESPONSIBILITIES



AIRPORT MANAGER

He is directly responsible to the Project Leader for safe and efficient operations at the airport. Primary responsibilities will include:

1. Insecticide mixing
2. Insecticide loading
3. Records
4. Supplies for the whole project
5. Communications

The Airport Manager will supervise 2 or more assistants depending on the needs. He will also coordinate mixing and loading activities with Chevron representatives.

MIXING AND LOADING

The anticipated arrangements are that Chevron Corp. will provide the mixing truck with loading pump and crew. However, this needs to be confirmed. In addition, arrangements should be made to obtain Orthene Forest Spray (7000 lbs) from Millinocket (State supply). Water soluble dye and water will be needed at the airport. One of the major jobs will be to supervise mixing of chemicals to provide timely supply for aircraft.

A variety of mixing combinations are presented in the attached table. However, a log should be maintained for each load mixed, showing what and how much was added. Also, records then should be kept as to where the mixed load is delivered. During the operation, 1 person whould be assigned to keep records and nothing else.

AVAILABLE START Material	ADD TO GET THE FINAL MIX			
	0.67# OFS per qt	0.67# OFS per 2 qts	0.5# OFS per qt	0.5# OFS per 2 qts
OFS 1bs	21bs+3qts spray 3 a	11b+3qts spray 1.5 a	11b+2qts spray 2 a	11b+4qts spray 2 a
OFS 25# bag	+9.75gals spray 37.5a	+19.5gals spray 37.5a	+12.5gals spray 50 a	+25gals spray 50a
0.67# OFS per qt		1:1	3:1	3:5
0.67# OFS per 2 qts	4mix+2#OFS+1water spray 5 a		3mix+1#OFS+6water spray 9 a	3:1
0.5# OFS per qt	2:1	4mix+2water spray 3 a		1:1
0.5# OFS per 2 qts	12mix+5#OFS spray 12 a	12mix+1#OFS spray 6 a	4mix+11bOFS spray 4 a	

AIRPORT ESTABLISHMENT

The Greenville Airport will be used for the project. The major tasks should be arrangements with airport management for the use of it. The Airport Manager should identify the project area and zone it for minimum public use. The area should be large enough to accommodate mixing and refueling vehicles and the aircraft. Arrangements should be made for Project Hqtrs., where communications, records and supplies are kept.

COMMUNICATIONS

Arrangements have been made for a delivery of a radio communications system from the Gypsy Moth Applications Program. That will supply HQ radio and antenna, several vehicle radios, portable radios and airvraft units. In addition, the spray craft and the observer planes will have standard aircraft frequency radios. The Maine Bureau of Forestry will require that at least the Bird Plane be in contact with Maine Project Operation.

AIRCRAFT CALIBRATION (Supervised by Project Leader)

The Beecomist spray heads will be provided to the contractor before the arrival to the spray airport. He will be expected to install them per instructions of the manufacturer. Adjustment values are required to regulate insecticide flow rate into the nozzle. If possible, calibration will be done before arrival to spray location.

A. TWO QUARTS PER ACRE - 4 BEECOMISTS

1. Flow rate of 10.1 gpm will be required (2.52 gpm for each nozzle) assuming air speed of 100 mph and swath width of 100 ft. If 66 ft swath is used, the calibration should be to give 6.7 gpm (1.7 gpm/nozzle).

2. Spray characterization will be made for evaluation by MAG. Two runs will be made across line of cards spaced 10 ft. apart. The flight will be into the wind.

3. Swath width will be determined by flying the aircraft cross-wind over a perpendicular line of spray cards, set out 10 gt. apart. Adequate spray deposit will be accepted when coverage is at least 10 drops per square centimeter (in the overlap area it should give at least 20 drops per sq. cm.).

B. ONE QUART PER ACRE - 4 BEECOMISTS

Follow the same technique as for A, except for flow rates, which should be reduced by 1/2.

C. ONE QUART PER ACRE - 2 BEECOMISTS

Follow the same techniques as for A, except shut-off 1 Beecomist on each side of aircraft. Check for flow rate which should be one half of that in A.

D. OPERATIONAL SPRAYING

1. Two quarts per acre rate will be applied with the 4 Beecomists.

2. One quart per acre rate will be applied with the 4 Beecomists.

APPENDUM IV

WORK PLAN FOR AERIAL OPERATIONAL TEST

"Comparison of Orthene Forest Spray at 0.5 lb and 0.67 lb in 1 qt and 2 qts Application Rates Per Acre Against the Eastern Spruce Budworm"

LABORATORY ACTIVITIES

May 9, 1978

Sample No	Number larvae

LABORATORY EXAMINATION

Lab Supervisor: Margaret Miller-Weeks is assigned the responsibility for coordinating branch examination with the crew-boss fo the Maine Bureau of Forestry crew. Among her responsibilities are the following:

1. Arrange for equipment and materials.

2. Arrange for approximate schedules.

3. Arrange for storage of branches until examination.

A. LARVAL COUNTS

The basic methods used by the Maine Bureau of Forestry will be followed. The final data should be presented showing number of live budworms per sample branch by size classes:

a. small - 2nd and 3rd instar; b. medium - 4th and 5th instar; c. large - primarily 6th instar; pupae; adult - current season's pupal skins.

B. DEFOLIATION ESTIMATES

Again, methods used by the Maine Bureau of Forestry will be followed. Defoliation estimates will be made for both prespray and postspray samples.

In addition, some individuals will be trained to estimate number of needles presnet on 10 major current growth shoots (terminal portion of brands). A destroyed bud will be counted as 0 needles.

C. BUDWORM REARING

Large larvae and live pupae found during the second postspray survey will be reared until all the moths have emerged or the insect has died. Rearing will be done in groups by tree clusters (3 tree samples in a cluster combined.

D. DATA RECORDING

All the data will be recorded on the bag label until final counts are complete. Final data will be transferred to 80 column computer sheet. NO SLIPS, DATA, OR MATERIALS WILL BE THROWN AWAY UNTIL APPROVED BY LABORATORY SUPERVISOR.

ADDENDUM T.

WORK PLAN FOR AERIAL OPERATIONAL TEST

"Comparison of Orthene Forest Spray at 0.5 lb and 0.67 lb in 1 qt and 2 qts Application Rates Per Acre Against the Eastern Spruce Budworm"

SAFETY PLAN

April 1, 1978

SAFETY PLAN FOR AERIAL SPRAYING OPERATIONS

INTRODUCTION

The objective of the plan is to prevent accidents by the pre-training and planning of procedures and equipment to be used, recognition of possible hazards to be encountered by personnel, and a search and rescue plan for quick recovery of downed pilots.

The contract outlines many provisions to safeguard this hazardous operation. These provisions are the results of recommendations based on previous experience, and sound practices included as a result of conferences with the Federal Aviation Agency and State Aeronautics Commission, and Forest Service regulations found in the Health and Safety Code Manual. These regulations also correspond with the OSHA standards for the Department of Labor. It will be necessary that safety standards be understood in detail by all personnel. They will be enforced as written.

The airfield must be approved as stated in the safety code by the authorized air operations officer before operations commence. Determination of safe operational conditions at the airfield is the responsibility of the Project Leader and will be delegated to the Air Safety Officer for the operation. Safety of all pilots in flight will be the responsibility of individual spray pilots and the Safety Officer. Safety of the contractor personnel at the parking and repairing areas, as well as at the loading stations, will be the responsibility of the Safety Officer and all personnel shall comply with the regulations in the Safety Plan and Forest Service Manual. Unsafe practices on the part of any personnel connected with the project will be reported to the Safety Officer. All accidents, incidents, hazards and abnormal happenings will be reported to the R-9 Regional Aviation Safety Officer.

Proper operations at the airport fall into four main categories: I. Training (general); II. Airport operations; III. Spray operations; and IV. Search and rescue operations.

I. Training

Training of individuals will be adequate to the requirements of the job to be done and will include complete awareness of the hazards involved. On-the-job training prior to the start of full scale operations will be utilized.

II. Airport Operations

A. Fire Hazard

"No Smoking" and "Unauthorized Personnel Keep Out" signs will be posted and observed in all areas of fire hazard.

Frequent inspections for leakage or overflow from storage tanks, pumps, or hose lines will be made. Washing down and neutralizing all spills will be the responsibility of the contractor and ground crew.

Ground wires and clamps will be provided at all stations dispensing insecticides and high octane gasoline and will be used at all times. Engines will be shut down during refilling. Fifteen pound fire extinguishers of the Purple K Type or equivalent shall be provided at each of the following locations. All extinguishers will be fully charged.

1. One at each loading station.

2. One at each pumping station (insecticide and high octane gasoline).

3. One at insecticide tank truck unloading station.

4. One in area where and when plane maintenance work is carried out.

5. One for each three planes, where and when planes are parked.

6. One should be easily accessible in the vicinity of project base (headquarters, etc.).

Spray planes will be equipped with "quick disconnect" fittings for loading insecticide. Before planes are loaded with insecticides, engines will be shut off and instructions will be given on the use of fire extinguishers to loaders and pump operators.

B. First Aid Equipment and Reporting

First aid equipment will be available at the following locations:

All Federal vehicles at the airfield.

An ambulance or emergency vehicle will be equipped with one 10-25 man kit.

Cases requiring medical or hospital care will be given emergency treatment and transported to the local hospital as quickly as possible.

Emergency telephone numbers will be posted at project base for ambulance and hospital, as well as police and fire services.

All injuries, regardless of seriousness, shall be given immediate attention. Contractor's personnel and FS personnel will report all injuries and incidents to the Project Leader or Acting Leader. All emergency dropping of loads will be reported and documented on FS5700-14.

C. Ground Regulations

The following regulations will be observed by all project personnel:

1. Smoking or the use of matches, lighters, and other open flames in restricted areas will not be permitted.

2. No unauthorized persons shall enter the restricted areas at any time unless accompanied by an authorized person.

3. Daily inspection of runways will be made to see that they are safe for take off and landing. The Air Safety Officer will be notified prior to making runway inspection and will be advised of conditions upon completion of the inspection by the Airport Manager.

4. When planes are taxiing into loading stations, loading personnel will remain at their station where they will be in full view of the pilot.

5. Loading station personnel will remain behind the trailing edge of the wind of parked aircraft while the engine is running.

6. No service or repair work on planes will be done in the loading area or its approaches without permission of the Aviation Safety Officer.

III. Spray Operations

Flight patterns for the take off and landing will be predetermined and posted. All pilots will be briefed on existing pattern. Project headquarters will notify all pilots and ground personnel of any changes in the flight pattern. The flight pattern will be determined by the Airport Manager in cooperation with the Project Leader. Except for emergencies, no changes in established flight pattern will be permitted.

The pilot shall be responsible for the safety of the aircraft and cargo. Except in emergency, spray pilots will secure approval of the Project Leader before making any changes in flight plans.

In accordance with contract specifications, safety belts, including shoulder harnesses with inertial reels, and crash helmets shall be worm properly by spray pilots while planes are being oeprated.

All airplanes used by the contractor on the project will be operated in conformity with the contract. Sections of the contract dealing with safety features regarding the planes will be considered part of this safety plan.

The Project Leader or the Aviation Safety Officer may suspend operations when, in his judgement, excessive and continuous flying is hazardous to pilots and results in unsatisfactory performance.

Spray planes taking off from the airport runways will be spaced so that the following plane will not be affected by the prop wash of the leading plane.

Spray aircraft will make radio check prior to take off.

The FAA office responsible for the geographic area containing the project will be notified of the spray operations by the Project Leader.

An observation aircraft will be in the air throughout the period of spraying. The observers responsibilities will include performance monitoring, communications relay and directing rescue personnel to the area of an accident.

Hazard Conditions in the Spray Area

The elevations of land within and immediately adjacent to the spray areas range from 1000 to 3500 feet above sea level.

A hazard map has been prepared to show elevations, and other hazard conditions and critical areas within and adjacent to the spray area. Pilots will be briefed on these conditions before the orientation and familiarization flying of the project area as provided in the contract. This map will be located in the pilot briefing room.

Spray schedules will be arranged so that poor visibility will not effect the safety of the pilots.

During regular briefing sessions, the safety program will be reviewed and unsafe practices pointed out and discussed and corrected.

IV. Search and Rescue Planning

A. Accidents to aircraft at or in the vicinity of the airport.

1. Insecticides dispensers or loading clerk will report immediately to Safety Officer and Project headquarters.

2. The emergency vehicle, which is a radio equipped state vehicle, and standby fire truck will go immediately to the scene of the crash.

3. If the location of the crash cannot be reached by the standby fire truck, the operator will radio the local firehouse for assistance.

4. Communications to project headquarters will be relayed through the fire department radio and load checker vehicle.

5. Project headquarters will secure assistance as requested by personnel at the scene of the accident.

B. Accidents occurring away from the airport.

Spray pilots will be in radio contact with project headquarters, the airport, and observer plane at all times.

Reporting of aircraft crash will be in the following manner.

1. After 15 minutes of continual loss of radio and visual contact with the spray planes, rescue operations will begin.

2. Pilot of plane involved, or other spray pilots in the vicinity or the observation plane pilot will radio the Safety Officer.

3. Safety Officer will proceed to the accident site and communicate with project headquarters giving location of accident and other pertinent information.

4. The Safety Officer will remain in the vicinity of the crash to guide ground crews to the scene of the accident and maintain constant communication with project headquarters.

C. Action before plane is located on the ground.

Project Headquarters

1. Dispatch a ground rescue crew, provided with portable radio to crash area. Maintain constant communication with the rescue crew.

2. Alert qualified search pilots if needed.

3. Alert medical and ambulance personnel.

4. Alert local hospital.

D. Action when plane is located on the ground.

Project Headquarters

1. If air rescue is needed, notify prior arranged facilities and give location of accident. See headquarters bulletin board for telephone numbers.

2. Keep in communication with rescue squad and start medical and ambulance service to the scene of the crash.

3. Notify Staff Director, FIDM.

Rescue Crew

1. Take whatever action needed to save life of the pilot.
2. Report condition of pilot to medical unit.

In Case of Fatality

A. Notify - the Director's Office (AD Support Services) 215-596-1626.

1. Regional Air Officer - 414-224-3632
2. Local FAA -
3. Start Investigations.

B. Other Telephone Contacts

1. State Police -
2. Local Police -
3. Local Fire Department -
4. Medical and Ambulance -
5. Local Hospital -

Training for Mixing Crew

Basic First Aid

Radio Communications

On Site Equipment

First Aid Kit (10 man)

Eye Wash Kit

Fresh Water (carboy)

Soap

Safety Goggles or Glasses

Disposable Coveralls

Rubber Gloves (for dangerous chemicals)

Hard Hats (bright color with chin strap)

Posted Material

Telephone Numbers (Emergency, etc.)

OSHA and Forest Service Standards

Operating Procedures

Maps (Hazard and Area)

Field Crew Safety

The field supervisors will have an initial orientation and training session to familiarize the field crews with all safety procedures. The crews will be supplied with all the needed written information, including this safety plan, F.S. manual, and forms to fill out in case of an accident. They will have a basic knowledge of first air to be able to handle on-site problems. They will report all accidents to Project Leader, so that all forms and procedures can be filled out and carried out. The field crew members will be made aware of these procedures.

Procedures

1. Evaluate the problem (stay calm).

2. Administer needed first-aid.

3. Notify - If emergency services needed; ambulance, police, etc. If not, transport to nearest medical facility.

4. Notify your supervisor so that reporting procedures can be carried out.

Field Safety

1. Use of proper clothing and equipment:

   a. wear - proper clothing for protection

   b. wear - proper boots for walking and other hazards encountered.

   c. wear - hardhats and eye protection.

   d. carry insect repellent, first aid kits, as needed.

   e. carry telephone emergency numbers.

The crews will consist of 2 persons or more with the proper training and equipment to carry on a safe field operation.

If an accident does occur it is to be reported to the project leader or designated safety officer, and proper treatment received as quickly as possible.

Equipment for this project

1. field clothes

2. hard hats

3. goggles for eye protection

4. first aid kits

5. copy of list of emergency numbers for each crew

Special Emergencies

A. Bee sting allergy - "Stay Calm"

1. Check for Medi-Alert bracelet, etc.

2. If conscious, transport as quickly as possible to doctor, or medical facility. Antihistamines can help at this time.

3. If unconscious, use same as above, but try to get the transportation by a professional service.

4. Call ahead and alert medical services of the problem.

Radio Communications

The use of a good communication system with back-up capabilities is a must for aerial spray programs.

1. Ground Safety - The use of radios to report to base problems of medical nature. The base can then start emergency procedures to get the proper medical services.

2. Aerial Safety - The use of radios for constant contact with aircraft and field crews to report any incidents to the Project Leader at the base; ability to report engine or equipment problems, dumping of load, aircraft down; initiation of proper action such as search and rescue, check-out load dumping site, etc.

System

1. Repeater - Portable mountain top givew weak portable units ability to reach base, includes towers and antennas, etc.

2. Base radio - at field lab. Ability to use for field crew operations through repeater, tower and antenna.

3. Mobile car radios 60 watt - to give better range to the repeater and field portables.

4. Tower with antenna at airport, to attach mobile car radio to guarantee reaching repeater.

5. Handi-talkies for field crews.

6. Radio transceivers to communicate with aircraft directly.

This system has two parts:

1. Forest Service frequencies with equipment to complete an Airnet.

2. Radar transceivers to allow contact with planes' radios directly.

System Use

A - Set-up system and test

B - Train personnel in proper use

C - Train personnel in emergency procedures

D - Use for project

This radio system will give the added safety of continuous contact between the field crews, and between the crews and their supervisors. It will also allow contact with our cooperators during the project. Any problems arising during the project can be handled by radio to prevent them from becoming bigger than necessary.

The purpose of this radio system is to give a quick response to any problem, such as injury or aircraft engine malfunction, as well as small every day questions that need to be answered by the crew leader.

Emergency Telephone Numbers